Progress in forward-inverse modeling based on vector radiative transfer models for coupled atmosphere-surface systems and machine learning tools

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An overview will be provided of forward and inverse radiative transfer in coupled atmosphere-surface systems [1]. A coupled system consisting of two adjacent slabs separated by an interface across which the refractive index changes abruptly from its value in air to that in ice/water will be used as an example. Several examples [2,3] of how to formulate and solve inverse problems involving coupled atmosphere-water systems will be provided to illustrate how solutions to the vector radiative transfer equation can be used as a forward model to solve practical inverse problems. Treatment of two-dimensional surface roughness, Earth curvature effects, and ocean bottom reflection for shallow water in coastal areas will be discussed, and the advantage of using powerful machine learning techniques to solve the inverse problem will be demonstrated.

References

[1] Stamnes, K., and J. J. Stamnes, 2015: *Radiative Transfer in Coupled Environmental Systems*. Weinheim, Germany: Wiley-VCH.

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[3] Stamnes, S., Y. Fan, N. Chen, W. Li, T. Tanikawa, Z. Lin, X. Liu, S. Burton, A. Omar, J. J. Stamnes, B. Cairns, and K. Stamnes, 2018: Advantages of measuring the *Q* Stokes parameter in addition to the total radiance *I* in the detection of absorbing aerosols. *Front. Earth Sci*. **6**, 34.

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